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THE
ONTARIO WATER RESOURCES
COMMISSION
WATER POLLUTION SURVEY
of the
CITY OF BELLEVILLE
COUNTY OF HASTINGS

October, 1965

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Report on a water pollution
survey of the city of Belleville in
the county of Hastings.

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THE
ONTARIO WATER RESOURCES COMMISSION

REPORT ON

a

WATER POLLUTION SURVEY

of the

CITY OF BELLEVILLE

in the

COUNTY OF HASTINGS

Division of Sanitary Engineering

October 1965

Report on a
WATER POLLUTION SURVEY
of the
CITY OF BELLEVILLE

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Report on a
WATER POLLUTION SURVEY
of the
CITY OF BELLEVILLE

INTRODUCTION

A water pollution survey of the City of Belleville was performed during the period of June 21 to 25, 1965. Surveys of this type are made by the OWRC in order to locate potential and existing sources of surface-water pollution. The control of surface-water quality is a major responsibility of this Commission. Recommendations are made concerning the abatement of conditions which adversely affect water quality. Appended to this report is a map of Belleville showing the locations of sampling points.

INTERVIEWS WITH OFFICIALS

Discussions were held with the following officials during this survey:

City of Belleville:

Mr. J. R. Reynolds, City Manager;
Mr. A. S. Stalker, City Clerk;
Mr. E. L. Burnham, P. Eng., Manager,
Public Utilities Commission;
Mr. W. C. Purcell, P. Eng., City Engineer;
Mr. R. Kraft, P. Eng., Assistant City Engineer;
Mr. R. F. Westlake, Public Health Inspector,
City Health Department.

Moira River Conservation Authority:

Mr. G. Wishart, Chairman;
Mr. J. F. King, Field Officer;
Mr. J. H. McLeod, Secretary-Treasurer.

Belleville and Suburban Planning Board:

Mr. J. Beavis, Director.

CITY OF BELLEVILLE

Belleville is located on the north shore of the Bay of Quinte in the County of Hastings. According to the 1965 Municipal Directory, the population of Belleville is approximately 31,960. The area of the city is approximately 7,655 acres.

The Moira River flows in a southerly direction through the central part of Belleville to empty into the Bay of Quinte. Most of the flows passing Belleville in the Bay of Quinte emanate from the Trent River which empties into the bay approximately 10 miles upstream at the Town of Trenton.

MOIRA RIVER AT BELLEVILLE

The Moira River system drains a watershed comprising approximately 1,056 square miles. Gradients on the Moira River system are comparatively steep, with the main watercourse dropping approximately 854 feet during its course of 91.6 miles, or an average gradient of 9.32 feet per mile.

A hydrometric station is located on the river east of the hamlet of Foxboro and approximately five miles upstream from Belleville. The drainage area upstream from this hydrometric station is 1,038 square miles. The pertinent flow records are of interest in a description of the Moira River in the Belleville area. The following hydrologic information with respect to this

stream gauging station was provided by the Water Resources Branch,
Department of Northern Affairs and National Resources:

Maximum recorded flow - March 31, 1936 - 12,400 cfs;
(cubic feet per second)

Instantaneous minimum recorded flow - September 3, 1964
- 12.7 cfs;

Mean daily flow on June 23, 1965 - 100 cfs.
(Date of river sampling during this survey)

The Moira River Conservation Authority has been active
in many phases of stream and watershed management, and has assisted
the OWRC in conducting co-operative water-quality studies.

WATER USES

Municipal

The Bay of Quinte is the source of Belleville's municipal
water supply. The water purification plant is located on the
shoreline in the western part of the city.

The effluent from the municipal sewage treatment works
is discharged to the Bay of Quinte east of the mouth of the Moira
River.

Industrial

Industrial waste waters are discharged from several
premises in Belleville to the Moira River and the Bay of Quinte.
These conditions will be discussed later in this report.

Recreational

Many potential bathing areas in the city have been plac-
carded by the authority of the medical officer of health based on

the results of water samples collected at these bathing areas for bacteriological examination. Warning notices are posted at the beaches when coliforms in excess of 1,000 organisms per 100 cubic centimetres are detected in two consecutive samples. A popular bathing area is located at the abandoned dam in the northern part of Belleville. Another recreational area in great favour is situated on Zwick Island which by sanitary landfill procedures has become a peninsula projecting into the Bay of Quinte. Facilities at this site include city water services and sub-surface sewage disposal systems.

WATER SUPPLY

The municipal water purification plant is located on the shoreline of the Bay of Quinte at the foot of Sidney Street. The water supply is drawn from the Bay of Quinte through the 30-inch diameter steel intake conduit which extends outward for approximately 1,890 feet from the plant to terminate where the depth of the water is approximately 16 feet.

The water purification facilities include micro-strainer units, coagulation and settling tanks, and gravity filters. Pre-chlorination is practised. Water storage is provided by a clear water reservoir at the plant having a capacity of one million gallons, and an elevated tank in the distribution system having a capacity of 0.75 million gallons.

The average daily pumpage and the maximum daily pumpage for the year 1964 were 4.2 and 7.3 million gallons, respectively. Approximately 5,000 domestic water services are unmetered. It was reported that meters eventually will be installed on all services.

Consideration is being given to expanding the treatment capacity of the water purification plant.

Problems have occurred intermittently with respect to unpalatability of the municipal water supply. Members of the OWRC staff have performed extensive investigations to assist in controlling these objectionable conditions which, for the most part, appear to have been caused by algae in the Bay of Quinte. These problems occasionally are aggravated by the presence of phenols in the raw water supply. The waters of the Bay of Quinte are highly mineralized and support a luxuriant growth of algae. The problems associated with the raw water quality at Belleville are very complex.

SURFACE WATER DRAINAGE

Municipal storm sewers and drainage courses conduct surface run-off flows to the Moira River and to the Bay of Quinte.

A natural drainage course conducts surface water flows from the Hillcrest area (east of Cannifton Road and north of College Street) to the Moira River. A small watercourse drains a low-lying area located north of Pine Street in the vicinity of

Herchimer Avenue, and pursues an easterly course from the city to empty into the Bay of Quinte downstream from Belleville. The only flow in this creek on June 23, 1965, was emanating from a municipal storm sewer outlet at Herchimer Avenue.

SEWAGE WORKS

Construction of this OWRC project was commenced in 1961 and was completed during the latter months of 1962. The sewage works include the primary treatment units and three sewage pumping stations. The plant was designed for a population of 30,000, and the average design plant flow is 3.0 million gpd (gallons per day) with a maximum of 9.0 million gpd.

Although most of the city is served by sanitary sewers, there are some areas where sewers have not been provided and will not likely be installed during the immediate future. Two specific instances are at the Hillcrest area and at what is known as the "Foster Ward". Sub-surface sewage disposal systems and pail-type privies are utilized at residences in the Hillcrest area where the municipality has taken action to deter residential expansion. The "Foster Ward" is located south of Dundas Street and east of the Moira River. Reportedly, some of the sewage flows from this area either gain direct access to surface waters or discharge thereto via storm sewers. Residential development has been discouraged in both of these areas, probably due in part to the difficulty anticipated in recovering the cost of installing

sanitary sewers and any pumping units.

The existence of some combined sewers, such as in the Front Street area, contributes to a higher hydraulic loading on the sewage treatment facilities than would occur if separate sewers were provided. The municipal officials are pursuing an active programme of separating these flows.

A municipal sanitary sewer extends to the Hastings County Home for the Aged which is located on the north side of Highway 2 just west of the city boundary. This institution is served also by Belleville's water supply.

Sewage Pumping Stations

Descriptions of the three sewage pumping stations and the pertinent overflow arrangements are provided as follows:

Dundas Street Pumping Station

This unit is located south of Dundas Street West (Highway 2) opposite the Ontario School for the Deaf. Although it was reported that sewage overflows have not occurred at this unit, it is probable that flows could be by-passed towards the bay.

Front Street Pumping Station

This unit receives sewage from many areas where combined sewers still exist. Reportedly, flows are by-passed to the Moira River when the incoming flows exceed the rate of approximately 5.5 to 6.0 mgd (million gallons per day). By-passing is employed consistently during periods of surface run-off but is not required during periods of dry weather.

Plant Pumping Station

Located just east of the sewage treatment plant is this unit which receives flows from an area where separate sewers are predominant. Reportedly, by-passing does not occur at this pumping station although a relief outfall to the bay is provided.

Sewage Treatment Plant

This primary treatment plant was designed for an average daily flow of 3.0 million gallons and a maximum daily plant flow of 9.0 million gallons. The daily plant flow during the week of this survey in June, 1965, was approximately 4.8 million gallons. The treatment plant includes facilities for grit removal, screening, comminution, sedimentation, as well as digestion. Effluent chlorination is practised on a seasonal basis, with the outfall sewer being utilized for a chlorine contact chamber. The outfall works consist of 300 feet of 33-inch diameter concrete pipe and 1,179 feet of 36-inch diameter concrete pipe.

Detailed inspections of this plant by members of the OWRC staff have revealed that the average daily influent flows exceed the plant design capacity. This hydraulic overloading is attributed to the influence of flows from combined sewers, and perhaps some infiltration.

The efficiency of a sewage treatment facility usually is assessed by the OWRC in terms of BOD and suspended solids removal. According to the laboratory results pertaining to

"grab" samples collected on June 23, 1965, the reduction in five-day BOD and suspended solids was approximately 61 per cent and 45 per cent, respectively.

INDUSTRY

The principal industrial firms located in Belleville are listed as follows:

<u>Name of Firm</u>	<u>Industry</u>
Aluminum Star Products Ltd.	Aluminum plaques, letters, castings, etc.
American Optical Co. (Canada) Ltd.	Lens manufacturing
Amphfone (Canada) Ltd.	Horizontal output transformers
Avon Jewellery Ltd.	Costume jewellery
Bay of Quinte Fisheries	Packing frozen fish
Bell Shirt Co. Ltd.	Shirts
Belleville Creameries	Dairy products
Bellewood Mfg. Co. Ltd.	Wood frames and sash
Caraquet Packers Ltd.	Processing and packing fish
Carm's Beverages	Beverages
Clark's Slaughterhouse	Slaughtering livestock
Coco-Cola Co. Ltd.	Beverages
Deacon Bros. Ltd.	Spratswear
Dussek Bros. (Canada) Ltd.	Cable oils and compounds, paint driers, etc.
Electronic Controls Ltd.	Electronic equipment for industry
Foley Foundry and Machine Co. Ltd.	Steel fabrication, etc.
Glen Roy Creamery & Frosty Lockers	Dairy products
W. T. Hawkins Ltd.	Popcorn, corn meal, etc.
Lecithin Products Canada Ltd.	Soy bean oil
Lee Grills Dairy	Dairy products
Mead Johnson of Canada Ltd.	Nutritional and pharmaceutical products for infants
Moirs Beverages Ltd.	Beverages
Morch Manufacturing Ltd.	Toolmakers, etc.
Northern Electric Co. Ltd.	Electronic devices
Reid's Dairy	Dairy products
Roblin Dairy	Dairy products
Seven Up Ontario Ltd.	Beverages
Stephens-Adamson Mfg. Co. of Canada Ltd.	Hoisting and conveying equipment
Stewart-Warner Corp. of Canada Ltd.	Lubricating equipment, etc.
Union Carbide Canada Ltd. (Bakelite Division)	Plastic

<u>Name of Firm</u>	<u>Industry</u>
Vagden Mills Ltd.	Men's and boy's hosiery
Wilson Concrete Products Ltd.	Concrete building materials

Enquiries and investigations indicate that most of these industrial firms discharge industrial waste flows to the municipal sanitary or combined sewers. The type of manufacturing or processing performed on some premises is such that an industrial waste flow either is **not** produced or is minimal in volume. Direct discharges from industrial premises to watercourses were sampled during this survey and pertain to the following firms:

Union Carbide Canada Ltd.;
Avon Jewellery Ltd.;
Lee Grills Dairy;
Moira Beverages Ltd.

PRIVATE OUTFALLS

Except for the sewage disposal problems associated with the Hillcrest area and the "Foster Ward", private sewage discharges to watercourses reportedly are few. Although a private sewer conducts waste of an objectionable quality from the Canadian National Railways premises to the Moira River, reasonable assurance has been given that this problem will be corrected. The Cedar-dale Motel is located near the east bank of the Moira River in the northern part of Belleville and provides relatively permanent accommodation for the occupants of approximately 20 motel units. Investigations made by OWRC staff in 1963 revealed that the sub-surface sewage disposal system serving this motel was subject to

malfunction and was presenting a pollution hazard. This condition was reviewed on June 24, 1965, revealing no actual problem at that time. However, it is possible that the problem could recur. These premises do not appear to be suitable for the installation of a reliable conventional type of private sewage disposal system, and are located somewhat remote from existing or proposed municipal sanitary sewers.

MUNICIPAL REFUSE DISPOSAL SITE

For several years the City of Belleville has conducted refuse disposal operations in the Bay of Quinte west of the mouth of the Moira River. Although these operations have been designed to reclaim sections of the bay which are somewhat shallow and marshy, it is probable that the ease of accessibility has prompted the municipality to select and continue the use of this area. The initial operation involved the reclaiming of water lots lying west of the Bay Bridge Road (Highway 14), which linked Zwick Island to the mainland. The use of the site for refuse disposal operations has been terminated and the area has been covered with clay material.

Subsequently, the reclaiming of water lots for refuse disposal was commenced east of Highway 14 and, according to present proposals, will result in the project extending outward for approximately 1,500 feet into the bay. By utilizing material obtained from the bottom of the bay, dykes have been constructed

around the area proposed for ultimate use. The practice has been to create cells which are utilized as the demand occurs. No selectivity is practised with regard to the types of material deposited in the refuse disposal area.

The OWRC is very concerned about the eventual effects of such a refuse disposal operation on the quality of surface waters. Experience has shown that leachates from decomposing organic material can adversely affect the quality of adjacent waters for many years unless adequate precautions are taken. Present information dictates that landfill sites operated near watercourses should be constructed behind impermeable barriers, and limited to non-combustible, non-putrescible, relatively inert materials that might include incinerator ash, building rubble, and excavation materials. Since land for refuse disposal operations is becoming costly and even difficult to acquire in and near urban centres, perhaps incineration of organic or combustible refuse should be considered seriously. The fact that incineration reduces the original volume of combustibles by approximately 85 per cent is one important reason why municipalities should conserve refuse disposal space by depositing only the relatively inert incinerator ash which also is less likely to produce a leachate hazardous to water quality.

The laboratory results pertaining to water samples collected at Belleville's refuse disposal operation are shown

in Table III.

The depositing of rubble and debris on the west bank of the Moira River in Belleville was investigated by OWRC staff on June 8, 1965. The pertinent premises are owned by Mr. F. S. Follwell of Belleville. Refuse material resulting from the demolition of buildings has been placed on the face of the river bank in such a manner that it has fallen to the edge of the stream bed within the high water level of the river. Adequate corrective action was requested in a report prepared subsequent to the inspection.

SAMPLING PROCEDURE

Samples were collected from the Bay of Quinte on June 22, from the Moira River and all outfalls to watercourses on June 23, and at the refuse disposal site on June 24. The appended map of the City of Belleville indicates the locations of sampling points. The pertinent laboratory results are appended in Tables I to V, inclusive.

The following information was obtained from the records provided at Belleville's water purification plant, and is of interest in interpreting the sample results:

<u>Date</u> <u>1965</u>	<u>General</u> <u>Weather</u> <u>Observations</u>	<u>Maximum</u> <u>Atmospheric</u> <u>Temperature</u>	<u>Wind</u> <u>Direction &</u> <u>Velocity</u>	<u>Precipi-</u> <u>tation</u>	<u>Water</u> <u>Temperature</u> <u>of Bay of</u> <u>Quinte</u>
June 22	Clear	79°F	Noon-S.W. at 2 mph	trace	70°F
June 23	Cloudy Intervals	76°F	8:00 a.m.-W. at 1 mph	7:35-8:45 a.m. trace	
			12:00 noon- S.W. at 3 mph	8:05 p.m. - 9:25 p.m. 0.54 inches	70°F
June 24	Clear	74°F	8:00 a.m.-W. at 3 mph	--	70°F
			12:00 noon - W. at 3 mph		

INTERPRETATION AND SIGNIFICANCE OF LABORATORY RESULTS

The analyses employed to determine the quality of samples include: biochemical oxygen demand (BOD), solids, nitrogen, phenolic equivalents, and detergents. Bacteriological examinations were performed to enumerate coliform organisms.

The BOD of sewage, industrial wastes, or polluted waters, is the oxygen required during stabilization of the decomposable organic or chemical material by aerobic biochemical action. A five-day BOD determination with incubation at 20 degrees Centigrade is reported. The BOD of a watercourse should not exceed four parts per million (ppm).

The analyses for solids include tests for total, suspended and dissolved solids. The results are reported in

parts per million. The first test measures both the solids in solution and in suspension. The suspended solids indicate the measure of undissolved solids of organic or inorganic nature in suspension. Significant sources of suspended solids are sewage, industrial wastes, and land erosion. Suspended solids in water can present difficulties in water purification, and might result in depositions in streams which can interfere with the habitat of aquatic life. The dissolved solids are a measure of those solids in solution.

Nitrogen determinations were performed in some instances to ascertain the nitrogen content of watercourses. Ammonia nitrogen, which sometimes is called free ammonia, is the soluble material produced in the decomposition of nitrogenous organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amounts of ammonia might be taken from the atmosphere in rainwater. The following values might be used in appraising free ammonia content:

Low	- 0.015 to 0.03 ppm
Moderate	- 0.03 to 0.10 ppm
High	- 0.10 or greater

Total Kjeldahl nitrogen is a measure of the total nitrogenous material present except that which is measured as nitrite and nitrate nitrogens. The total Kjeldahl nitrogen less the ammonia nitrogen measures the organic nitrogen present.

Ammonia and organic nitrogen values are important in determining the availability of nitrogen for biological utilization. The normal range for total Kjeldahl nitrogen is 0.1 to 0.5 ppm. Nitrite nitrogen usually is an intermediate oxidation product of ammonia. The significance of nitrite varies with the amount, source, and relationship to other constituents of the sample, notably the relative magnitude of ammonia and nitrate present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of one part per million is generally indicative of active biological processes in the water. Nitrate nitrogen is the final product of aerobic decomposition of nitrogenous matter, and its presence implies this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that might be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility. The following ranges in the concentration of nitrate may serve as a guide.

Low	- less than 0.1 ppm
Moderate	- 0.1 to 1.0 ppm
High	- greater than 1.0 ppm

The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products, or with wastes from some chemical industries. It is generally conceded that adequate protection of surface waters

will be provided if the concentration of phenol or phenolic equivalents does not exceed an average of two parts per billion (ppb) and a maximum of five ppb following initial dilution. Phenolic type waste can cause objectionable conditions in water supplies and might taint the flesh of fish.

The presence of anionic detergents as ABS usually is an indication that domestic waste is present.

The coliform count is employed to obtain an enumeration of coliform organisms. The presence of coliforms indicates pollution by human or animal excrement, or by some non-faecal forms. The number of coliforms is reported per 100 millilitres (ml) of the sample. The membrane filter technique was used in the examination of these samples. It is the opinion of the OWRC that the presence of coliforms in a watercourse should not exceed 2,400 organisms per 100 ml of water.

SAMPLE RESULTS

The laboratory results are shown in appendices to this report as follows:

Table I	-	Bay of Quinte at Belleville
Table II	-	Moirs River in Belleville
Table III	-	Samples Pertaining to Municipal Refuse Disposal Site
Table IV	-	Municipal Outfalls to Watercourses in Belleville
Table V	-	Private and Industrial Discharges to Watercourses in Belleville.

Bay of Quinte at Belleville

The quality of the Bay of Quinte water at Belleville was generally satisfactory according to the analyses which were performed. It is emphasized that these tests do not apply to the conditions associated with aquatic vegetation.

Concentrations of phenol or phenolic equivalents were revealed in the bay at the western and eastern limits of Belleville, although the content thereof could not be described as critical at the time of sampling. The Total Kjeldahl nitrogen was high in all of the water samples collected from the bay during this survey. The free ammonia content was high at sample point number BQ 40.88 which is located in the small bay east of the municipal water works intake. This condition might be attributed, at least in part, to the leaching of material from the abandoned refuse disposal site. The proposal to fill this small inlet with select material in an acceptable manner could assist in controlling any leaching from this section of the abandoned refuse disposal area which extends from the former shoreline to Zwick Island.

Moir River in Belleville

The sample results pertaining to the Moira River in Belleville reveal the presence of phenolic equivalents in the river water at the CPR bridge and at College Street. The five-day BOD was appreciable at the footbridge opposite Catherine

Street. High values for free ammonia and Total Kjeldahl nitrogen were revealed in the river at sample points M 0.40 and M 0.75 which are located at the CPR bridge and at the footbridge, respectively. A substantial coliform content was revealed in the river at the M-C Freeway (Highway #401).

Samples Pertaining to Municipal Refuse Disposal Site

Water samples were collected from the Bay of Quinte, and from the Moira River at its mouth, at sites located adjacent to the dyke which encloses the refuse disposal site. An additional sample was obtained from the water in an enclosed cell (designated as sample point D on map) at the disposal site. High free ammonia and Total Kjeldahl nitrogen values were revealed in all of the samples collected beside the refuse disposal dyke. In addition, high BOD and coliform contents were indicated at sample point B. The high free ammonia and Total Kjeldahl nitrogen aspects of water quality revealed near the disposal area, when compared with the relative absence of nitrates, indicate that pollution of very recent origin had occurred due to the predominance of the high values occurring in the initial stages of the nitrogen cycle. Of outstanding significance are the laboratory results pertaining to the water sample obtained at sample point D in the enclosure of the refuse site, where excessive contents of phenol, BOD, solids, iron, free ammonia, and Total Kjeldahl nitrogen, were revealed. These results demonstrate the

extremely high potential of this leachate for polluting the bay. Considering that the leaching process is likely to continue for many years, the seriousness of this refuse disposal procedure is indicated.

Municipal Outfalls to Watercourses in Belleville

The efficiency of the municipal sewage treatment plant was discussed earlier in this report.

A high coliform content was revealed in the discharge emanating from the municipal storm sewer at the foot of Foster Avenue on the shoreline of the bay.

The flows discharging from the drainage ditch which extends across the refuse disposal site had high contents of free ammonia and Total Kjeldahl nitrogen, probably due to the leaching of waste from exposed refuse material to the drainage course.

Objectionable conditions with respect to phenol and coliforms were revealed in the samples collected in the vicinity of the storm sewer outfall located on the west bank of the Moira River just north of the footbridge at Catherine Street.

An appreciable coliform content was indicated in the sample obtained from the storm sewer discharge at Herchimer Avenue where these flows gain access to a watercourse. There was no flow in this watercourse upstream from Herchimer Avenue on June 23, 1965.

Private and Industrial Discharges to
Watercourses in Belleville

The discharge from Lee Grills Dairy to the Moira River apparently was uncontaminated cooling water.

The waste discharging from the Moira Beverages Ltd. plant to the river had a high BOD and should be discharged to the sanitary sewer system.

The CNR sewer effluent had a high BOD and coliform content. Previous sampling had shown a high phenol content also.

Although the BOD of the Avon Jewellery Ltd. plant discharge was high, this waste was seeping into the ground without gaining access to the bay during this survey.

Sample results reveal the excessive BOD and phenol content in the discharge from the Union Carbide Canada Limited plant to the Bay of Quinte. The waste disposal procedures utilized at this plant are inspected periodically by members of the Division of Industrial Wastes, OWRC.

WATER QUALITY AT BATHING AREAS

As described previously in this report, the water at potential bathing areas in Belleville is sampled periodically during the summer months by the local health department staff. Warning notices are posted at the beaches when coliforms in excess of 1,000 organisms per 100 cubic centimetres are detected in two consecutive samples. The following tabulation reveals the laboratory results pertaining to water samples collected by

Mr. R. F. Westlake, Public Health Inspector, in 1965 prior to this

OWRC survey:

<u>Location of Bathing Area</u>	<u>Date of Sample 1965</u>	<u>BACTERIOLOGICAL EXAMINATION</u>	
		<u>Coliforms/100 c.c.</u>	<u>E. Coli/100 c.c.</u>
Moira River at Dam - west bank- opposite Cedar- dale Motel	May 3	150	23
	May 10	75	14
	May 20	93	9.1
	May 31	2,000	39
	June 7	150	93
	June 14	3,400	64
Moira River at St. Charles Street - West Side	May 3	93	23
	May 10	150	3
	May 20	93	93
	May 31	2,400	43
	June 7	140	93
	June 14	530	23
Bay of Quinte - at Yacht Club	May 3	1,500	1,100
	May 10	460	39
	May 20	110,000	11,000
Bay of Quinte - at Government Dock	May 3	2,400	460
	May 10	2,400	64
	May 20	1,100	240
Bay of Quinte at Wilkie Street (near west limit of city)	May 3	460	9.4
	May 10	150	150
	May 20	11,000	1,100
	May 31	1,500	240
	June 7	11,000	2,400
Bay of Quinte at Zwick Island (north side)	May 3	9.1	0
	May 10	43	0
	May 20	240	43
	May 31	110	7.3
	June 7	2,400	240
	June 14	1,100	23
Bay of Quinte at Zwick Island (south side)	May 3	140	9.1
	May 10	14	0
	May 20	24,000	1,500
	May 31	43	23
	June 7	1,100	23
	June 14	72	0

Bay of Quinte	May 3	1,100	1,100
at Herchimer	May 10	24,000	2,400
Avenue	May 20	24,000	240

SUMMARY

A water pollution survey of the City of Belleville was made during the period of June 21 to 25, 1965. Investigations were made to obtain information concerning discharges to the Bay of Quinte and the Moira River within the city, and to determine the influence exerted thereby on the quality of the watercourse.

Belleville has acquired a primary sewage treatment plant which was constructed as an OWRC project and was placed in operation during the latter part of 1962. Future action required will include the separating of combined sewage flows to alleviate the present hydraulic overloading of the sewage treatment facilities. The city is pursuing this difficult programme at the present time. Some unsewered sections of the city require either sanitary sewers or adequate private facilities for sewage disposal.

The most noteworthy aspect of water quality revealed in the Bay of Quinte during this survey is the nutrification which has occurred. The operation of the municipal refuse disposal site as an encroachment on the bay is unsatisfactory, and will continue to present a hazard to surface water quality unless adequate remedial action is taken.

Although the Moira River receives some contaminated discharges in Belleville, the laboratory results did not reveal

particularly adverse conditions in the watercourse within the city at the time of sampling. However, this section of the river does receive outfall flows of objectionable quality.

Contaminated flows were discharging to watercourses from three municipal storm sewer outfalls and one drainage course during this survey. Wastes of an objectionable quality were discharging to the Moira River from the Moira Beverages Limited plant and the CNR premises, and to the Bay of Quinte from the premises of Union Carbide Canada Limited. Although attempts have been made to provide waste treatment facilities at the Union Carbide Canada Limited plant, it is evident that additional action will be required. Industrial waste was being discharged from the Avon Jewellery Limited plant to a tile drain and thence to a ditch where it was seeping into the ground. This method of waste disposal is unsatisfactory.

RECOMMENDATIONS

1. The programme presently being pursued at Belleville to segregate combined sewage flows should be continued to exclude uncontaminated flows from the municipal sanitary sewers and thus alleviate the hydraulic overloading of the sewage treatment plant. It is important that contaminated flows should not be discharged to storm sewers.

2. Attempts should be made either to provide sanitary sewers in sections of the city still requiring such services, or to ensure that adequate private sewage disposal facilities are installed.

particularly adverse conditions in the watercourse within the city at the time of sampling. However, this section of the river does receive outfall flows of objectionable quality.

Contaminated flows were discharging to watercourses from three municipal storm sewer outfalls and one drainage course during this survey. Wastes of an objectionable quality were discharging to the Moira River from the Moira Beverages Limited plant and the CNR premises, and to the Bay of Quinte from the premises of Avon Jewellery Limited and Union Carbide Canada Limited. Although attempts have been made to provide waste treatment facilities at the Union Carbide Canada Limited plant, it is evident that additional action will be required.

RECOMMENDATIONS

1. The programme presently being pursued at Belleville to segregate combined sewage flows should be continued to exclude uncontaminated flows from the municipal sanitary sewers and thus alleviate the hydraulic overloading of the sewage treatment plant. It is important that contaminated flows should not be discharged to storm sewers.

2. Attempts should be made either to provide sanitary sewers in sections of the city still requiring such services, or to ensure that adequate private sewage disposal facilities are installed.

3. The location and method of operation associated with the municipal refuse disposal site are a source of grave concern to the OWRC and should be regarded critically by the city. The present refuse disposal site should be abandoned for its present use. By constructing impermeable dykes to enclose the area, select material or inert matter could be deposited within the enclosure if the main purpose of the procedure is to reclaim a shallow part of the bay for future development as a park. Consideration should be given to the incineration of combustible refuse material. As an alternative, a suitable site should be obtained elsewhere if sanitary landfill practices are to be pursued.

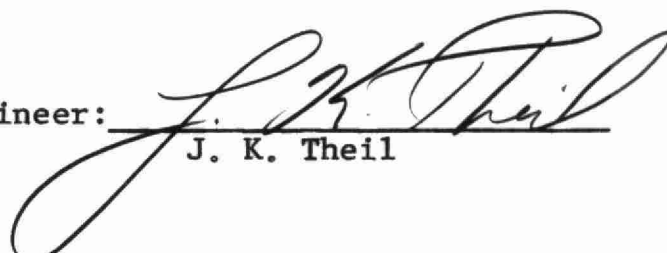
4. Action should be taken to exclude contaminants from the flows discharging from three municipal storm sewer outfalls and one drainage course.

5. Appropriate action should be undertaken by CNR officials to exclude sewage and waste petroleum products from the private sewer which extends from the CNR premises to the Moira River.

6. The principals concerned should adopt measures to prevent the discharging of untreated or inadequately treated industrial wastes to watercourses from the premises occupied by the following firms in Belleville: Moira Beverages Limited,

Avon Jewellery Limited, and Union Carbide Canada Limited.
Although some efforts have been made in this regard, it is
evident that additional improvements should be considered.

All of which is respectfully submitted,

District Engineer: 

J. K. Theil

Approved by: 

J. R. Barr, Director,
Division of Sanitary Engineering.

Prepared by: R. G. Barrens, Eng. Tech.

/mh

TABLE 1

BAY OF QUINTE AT BELLEVILLE

DATE SAMPLED: JUNE 22, 1965

ALL ANALYSES EXCEPT PH REPORTED IN
PPM UNLESS OTHERWISE INDICATED

SAMPLE POINT NO.	DESCRIPTION	PHENOL IN PPB	5-DAY BOD	TOTAL SOLIDS	TURBIDITY UNITS	ANIONIC DETERGENTS AS ABS	NITROGEN AS N				BACTERIOLOGICAL EXAMINATION
							FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	COLIFORMS/100 ML MEMBRANE FILTER
BQ 43.0 (1)	RANGE AT WEST LIMIT OF BELLEVILLE - 200 FT. OFFSHORE	6	2.0	210	4.5	0.0	TR	1.20	0.0	0.0	60
BQ 43.0 (2)	RANGE AT WEST LIMIT OF BELLEVILLE - 500 FT. OFFSHORE	2	1.8	210	4.0	0.0	TR	1.10	0.0	0.0	40
BQ 43.0 (3)	RANGE AT WEST LIMIT OF BELLEVILLE - 1000 FT. OFFSHORE	2	3.0	146	6.0	0.0	TR	1.30	0.0	0.0	0
BQ 40.90	BAY OF QUINTE AT BELLEVILLE WATER WORKS INTAKE	0	4.8	180	3.5	0.0	TR	1.10	0.0	0.0	60
BQ 40.88	INLET OF BAY EAST OF W.W. AND NORTH OF ZWICK ISLAND	0	2.4	218	9.5	---	0.22	1.22	---	---	30
BQ 40.85	BAY OF QUINTE AT NORTH SPAN OF CAUSEWAY (HWY. 14)	0	2.4	156	4.0	0.0	TR	1.30	0.0	0.0	20
BQ 40.98 (1)	RANGE OPPOSITE GEORGE ST. - 200 FT. OFFSHORE	2	7.2	154	3.3	---	TR	1.45	---	---	150
BQ 40.98 (2)	RANGE OPPOSITE GEORGE ST. - 500 FT. OFFSHORE	0	3.6	172	2.9	---	TR	1.30	---	---	130

TABLE 1 (CONT'D)

SAMPLE POINT NO.	DESCRIPTION	PHENOL IN PPB	5-DAY BOD	TOTAL SOLIDS	TURBI- DITY UNITS	CHLORIDE AS CL	NITROGEN		ALKALINITY AS CaCO_3	PH AT LAB.	BACTERIOLOGICAL EXAMINATION
							FREE AMMONIA	AS N TOTAL KJELDAHL			COLIFORMS/100 ML MEMBRANE FILTER
BQ 40.98 (3)	RANGE OPPOSITE GEORGE ST. - 2000 FT. OFFSHORE	0	4.6	180	3.5	6.0	TR	1.10	---		50
BQ 40.98 (4)	RANGE OPPOSITE GEORGE ST. - 2500 FT. OFFSHORE	0	4.0	166	2.1	5.0	TR	1.20	---		190
BQ 40.70 (1)	RANGE OPPOSITE FOSTER AVENUE - 200 FT. OFFSHORE	2	3.8	222	4.0	5.0	0.10	0.84	---		140
BQ 40.70 (2)	RANGE OPPOSITE FOSTER AVENUE - 1500 FT. OFFSHORE	2	3.6	168	4.0	5.0	TR	0.71	---		104
BQ 39.0 (1)	RANGE AT EAST LIMIT OF BELLEVILLE - 200 FT. OFFSHORE	4	3.0	222	4.0	6.0	TR	1.40	98	8.2	60
BQ 39.0 (2)	RANGE AT EAST LIMIT OF BELLEVILLE - 800 FT. OFFSHORE	4	4.6	216	5.0	5.0	0.06	0.84	99	8.4	100
BQ 39.0 (3)	RANGE AT EAST LIMIT OF BELLEVILLE - 2000 FT. OFFSHORE	4	2.8	222	4.5	5.0	TR	1.10	98	8.5	90

TABLE II

MOIRA RIVER IN BELLEVILLE

DATE OF SAMPLE 1965	SAMPLE POINT NO.	DESCRIPTION	PHENOL IN PPB	5-DAY BOD	S O L I D S			TURBI- DITY UNITS	IRON AS FE	N I T R O G E N		A S N		BACTERIOLOGICAL EXAMINATION COLIFORMS/100 ML MEMBRANE FILTER
					TOTAL	SUSP.	DISS.			FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	
JUNE 22	M. 0.40	MOIRA RIVER AT CPR BRIDGE NEAR MOUTH	4.0	2.5	168	---	---	1.1	---	0.13	1.20	TR	0.0	1,900
JUNE 23	M. 0.75	MOIRA RIVER AT FOOT- BRIDGE (OPPOSITE CATHERINE ST.)	0.0	5.8	168	---	---	---	0.25	0.20	0.58	--	---	210
JUNE 23	M. 1.8	MOIRA RIVER AT COLLEGE ST.	2.0	1.0	168	7	161	---	0.25	---	---	--	----	170
JUNE 23	M. 3.0	MOIRA RIVER AT HWY. 401 - NORTH LIMIT OF CITY	0.0	1.9	162	5	157	---	---	---	---	--	---	4,000

TABLE III

SAMPLES PERTAINING TO MUNICIPAL REFUSE DISPOSAL SITE

DATE OF SAMPLE 1965	SAMPLE POINT NO.	DESCRIPTION	PHENOL IN PPB	5-DAY BOD	S O L I D S			TURBI- DITY UNITS	IRON AS FE	N I T R O G E N A S N				BACTERIOLOGICAL EXAMINATION COLIFORMS/100 ML MEMBRANE FILTER
					TOTAL	SUSP.	DISS.			FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NIRATE	
JUNE 22	A	MOIRA RIVER AT EDGE OF LANDFILL DYKE - OPPOSITE ST. PAUL ST.	0.0	3.6	160	---	---	---		0.22	1.30	TR	0.0	80
JUNE 22	B	BAY AT EDGE OF LANDFILL DYKE - OPPOSITE TIP OF VICTORIA PARK	4.0	8.0	184	---	---	2.9		0.40	2.30	--	---	4,000
JUNE 24	C	BAY AT EAST SIDE OF LANDFILL DYKE	---	2.8	200	14	186	---	0.4	1.15	1.20	--	0.0	180
JULY 30	D	WATER ENCLOSED IN CELL BY DYKE	50,000	430.0	2980	160	2820		36.4	36.0	41.0	--	---	---
JUNE 24	E	BAY AT PARTIALLY EN- CLOSED AREA SOUTH OF LANDFILL AREA	---	3.0	182	22	160		0.81	0.98	1.80	--	0.0	10
JUNE 24	F	BAY AT PARTIALLY EN- CLOSED AREA NEAR HWY. 14	---	3.4	238	27	211		1.3	1.15	2.00	--	0.0	10
JUNE 24	G	BAY AT OUTER END OF DYKE	---	3.2	208	19	189		0.70	0.80	1.50	--	0.0	10

TABLE IV

MUNICIPAL OUTFALLS TO WATERCOURSES IN BELLEVILLE

DATE OF SAMPLE 1965	SAMPLE POINT NO.	DESCRIPTION	PHENOL IN PPB	5-DAY BOD	S O L I D S			IRON AS FE	N I T R O G E N		AS N	BACTERIOLOGICAL EXAMINATION	
					TOTAL	SUSP.	DISS.		FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	COLIFORMS/100 ML MEMBRANE FILTER
JUNE 21	BQ 42.47 W	DRAINAGE DITCH EXTENDING FROM PALMER ROAD TO BAY OF QUINTE						N O F L O W					
JUNE 21	BQ 42.11 W	MUNICIPAL STORM SEWER EXTEND- ING ALONG SIDNEY ST. TO BAY						N O F L O W					
JUNE 23	BQ 40.89 T	MUNICIPAL SEWAGE TREATMENT PLANT OUTFALL TO BAY		41.0	532	104	428					60,000	
JUNE 23	BQ 40.88 R	RELIEF SEWER OUTFALL FROM SEWAGE PUMPING STATION NEAR SEWAGE TREATMENT PLANT						N O F L O W					
JUNE 23	BQ 40.70 W	MUNICIPAL STORM SEWER AT FOOT OF FOSTER AVENUE		0.9	278	7	271					16,300	
JUNE 23	BQ 39.43 D	DRAINAGE COURSE TERMINAT- ING AT SHORELINE NEAR EAST LIMIT OF CITY						N O F L O W					
JUNE 24	M. 0.18 D	DRAINAGE DITCH EXTENDING THROUGH 2 REFUSE DISPOSAL SITE TO MOUTH OF MOIRA RIVER		4.4	688	14	674	3.2	6.60	7.90	---	0.0	300
JUNE 23	M. 0.41 WR	STORM SEWER ON EAST BANK OF RIVER AT END OF DUNDAS ST. E.						N O F L O W					
JUNE 23	M. 0.63 W(E)	STROM SEWER OUTLET ON E. BANK OF RIVER AT SOUTH SIDE OF BRIDGE ST.						NOT ACCESSIBLE FOR SAMPLING					
JUNE 23	M. 0.63 W(W)	STORM SEWER OUTLET ON W. BANK OF RIVER AT BRIDGE STREET						NO FLOW IN PERTINENT MANHOLE					
JUNE 23	M. 0.77 W	STORM SEWER OUTLET ON W. BANK OF RIVER AT NORTH SIDE OF CATHERINE STREET FOOTBRIDGE (VICINITY SAMPLE)	100	3.6	224	30	194	--	---	---	---	---	6,000
JUNE 23	M. 0.96 D	DRAINAGE COURSE DISCHARGING TO W. BANK OF RIVER NEAR MOIRA ST.		1.5	206	6	200	0.03	0.61				70
JUNE 23	M. 1.01 W	STORM SEWER OUTLET ON N.W. BANK OF RIVER AT GORDON STREET						N O F L O W					

TABLE IV (CONT'D)

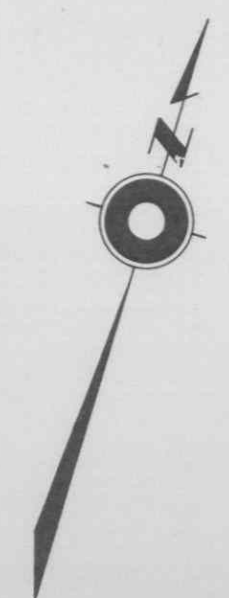
MUNICIPAL OUTFALLS TO WATERCOURSES IN BELLEVILLE

DATE OF SAMPLE <u>1965</u>	SAMPLE POINT NO.	DESCRIPTION	5-DAY BOD	S O L I D S			PHENOL IN PPB	BACTERIOLOGICAL EXAMINATION
				TOTAL	SUSP.	DISS.		COLIFORMS/100 ML MEMBRANE FILTER
JUNE 23	M. 1.34 D	DRAINAGE COURSE ORIGINATING IN HILLCREST AREA - DRAINING TO E. BANK OF MOIRA RIVER	1.0	520	9	511	4.0	430
JUNE 23	M. 1.61 D	DITCH TERMINATING ON W. BANK OF RIVER AT STONE STREET		N O F L O W				
<u>OTHER SURFACE WATER DRAINAGE</u>								
JUNE 23	X. 2.13 W	STORM SEWER DISCHARGING ON E. SIDE OF HERCHIMER AVE. TO SOUTH BANK OF DRAINAGE COURSE FLOWING EASTWARD FROM BELLEVILLE	0.6	472	10	462		3,700

TABLE V

PRIVATE AND INDUSTRIAL DISCHARGES TO WATERCOURSES IN BELLEVILLE

DATE OF SAMPLE 1965	SAMPLE POINT NO.	DESCRIPTION	5-DAY BOD	S O L I D S			PHENOL IN PPB	CYANIDE AS HCN	ETHER SOLUBLES	BACTERIOLOGICAL EXAMINATION COLIFORMS/100 ML MEMBRANE FILTER
				TOTAL	SUSP.	DISS.				
JUNE 24	M. 0.72 I	OUTFALL FROM LEE GRILLS DAIRY ON W. BANK OF MOIRA RIVER AT COLEMAN ST. NEAR JANE ST.	0.5	260	6	254	---	---	---	0
JUNE 24	M. 1.12 I	OUTFALL FROM MOIRA BEVERAGES LTD. PLANT ON W. BANK OF MOIRA RIVER	44.0	346	44	302	---	---	---	20
JUNE 23	M. 1.35 P	SEWER OUTFALL FROM CNR PREMISES TO E. BANK OF MOIRA RIVER NORTH OF CNR BRIDGE	100.0	446	80	366	4.0	---		470,000
JUNE 24	BQ 40.37 I	SEWER OUTFALL FROM AVON JEWELLERY LTD. PREMISES TO BAY OF QUINTE	47.0	456	104	352		0.0		---
JUNE 24	BQ 39.24 I(1)	UNION CARBIDE CANADA LTD. - COOLING WATER OUTFALL TO BAY OF QUINTE	2.2	194	2	192			4.5	---
JUNE 24	BQ 39.24 I(2)	UNION CARBIDE CANADA LTD - WASTE OUTFALL TO BAY	760.0	1868	134	1734	200,000		8.0	---



LEGEND

- (E) - REFUSE DISPOSAL SITE SAMPLING POINTS
- BQ-40.90 - LAKE AND STREAM SAMPLING POINTS
- BQ-40.70 - STREAM AND MILEAGE AT OUTFALL
- W - TYPE OF OUTFALL
- D - DITCH OR SMALL WATERCOURSE
- R - RELIEF SEWER
- T - TREATED SEWAGE
- W - STORM SEWER
- I - INDUSTRIAL EFFLUENT
- S.P.S. - SEWAGE PUMPING STATION

ONTARIO WATER RESOURCES COMMISSION

CITY OF BELLEVILLE

WATER POLLUTION SURVEY (1965)

SCALE: 0 1000 2000 3000 FEET

DRAWN BY: W.R.E. DATE: OCTOBER 1965

CHECKED BY: DRAWING N^o: 65-129